

CHAPTER ONE

Introduction

Sorghum is Africa's contribution to the small number of elite grains that supply about 85% of the world's food energy. Only far other foods rice, wheat, maize and barely are com consumed in greater amounts by the human race. Sorghum is the dietary staple of more than 500 million people in more than 30 countries of the semi-arid tropics, thus being one of most familiar foods in the world.(Borad, 1996).

Sorghum is the staple food in many African countries including the Sudan. It is the staple food in most regions of this country. It contains a reasonable amount of proteins, ash, carbohydrates, oils and fiber (Taylor, 2003).The Sudan, sorghum is widely grown in areas of sufficient rainfall or under irrigation and is the most popular food grain (Dillon, *et al.*, 2007).

Sorghum can be processed using technologies of dry and wet willing applied of the genome sequence will enhance future productions and nutritional quality of sorghum, its similar to maize (hard and floury endosperm and large fat – lich germ) (Icrisat, 2009).

Insect pest problems in sorghum can vary widely across well as from one season to the next pests with the greatest effective to decrease yield are the green bug and the sorghum midge, the latter particularly important in the southern half of the state .(www., 2016).

Most aphids are selective in the plants which they attack, but about 10% feed on a range of plants. Some aphid species do relatively little damage to the host plants, while others may present a serious threat if allowed to multiply. Aphid populations differ widely throughout the year in response to

seasonal factors and the attack of natural predators. For these reasons it is difficult to simplify about the need for interference in controlling aphids. The methods of aphids control may differ because there are so many different kinds of aphids and their life cycle and interactions with other insects in the ecosystem is complex, (Website, 2016).

Many chemicals were used to control aphids in the field , however, it was known that chemicals are not safety for human and environment, therefore the study aims to used a biological control agents to control sorghum aphid *R.maidis* by natural plants extracts. The specific objectives of this project were:

1. Collection of plant materials.
2. Preparation of aqueous extracts of three plant materials (damas, moringa ,cafure).
3. Evaluation of the effect of plant extracts on insect adult mortality.

CHAPTER TWO

LITERATURE REVIEW

2.1 Sorghum

2.1.1 Nutritional fact

In many countries where populations are food – insecure, residents know how to use sorghum and readily accept in their diets. Sorghum is an excellent source of energy mainly in the form of complex carbohydrate (fibers, starches) same as rice and cassava and about the same percent of protein as other grains (FAO 1995).

Sorghum is rich in B – complex vitamins are a perfect combination for energy utilizations. Sorghum is also rich in thiamin – riboflavone, niacin, pantothenate (Mohammed *et al*, 2010)

2.1.2 Uses

Sorghum is used to produce such foods as porridges breads, couscous, sorghum, flour, and syrup, malted flours for brewing, cookies, and cake (FAO 1995).

Some hybrids commonly grown for feed have been developed to deter birds, and therefore contain a high concentration of tannins and phenolic compounds, with reason the need for additional processing to allow the grain to be digested by cattle. Other uses of sorghum, it have been used as fuel (Shoemaker and Bransby, 2010).

2.1.3 Distribution

Sorghum is native to East Africa probably from Ethiopia but was also grown in India before recorded history and in Assyria's early as 700 BC, it was

introduced to the USA from Africa in the early part of the 17th century. It is now widespread between 50N (Baloleet *al* , 2006)

Sorghum considered as important agricultural grains such as wheat, rice, maize (corn) and sugar cane. Which are among the best known members of Poaceae.

2.1.4 Diseases of sorghum

Common rust fungus *Puccinia sorghi* pustules on upper and lower surfaces of leaves, pustules rupture and release powdery red spores, pustules turn brown, prowl red spores, pustules turn dark – brown – black as they mature and release dark brown prowl spores – pustule – may appear on tassel and ears and leaves may begin to yellow, control measures – fungicides are most effective when the amount of secondary molecules is still low (Thurston, 1998).

Bacterial blight – symptoms gray or yellow stripes with irregular margins on leaf surfaces stripes follow leaf veins and contain characteristic dark green to black water soaked spots. Control measure, plant resistant, crop rotation, plow crop debris into soil immediately after harvest. Hocus spot bacterium *Pseudomonas syringae* (Kuckarek, *et al*, 1992).

2.1.5 Pests of sorghum

Sorghum crops severely damaged by stem borer (*Chilo partellus*) stem borer a very serious pest of sorghum found throughout in India. Larval damage occurs as a series of small holes in lines (pin holes) in younger leaves or patches of transparent leaf epidermis (window panes) in older leaves. In case of younger plants, the growing point and base of central whorl gets badly damaged resulting in the drying of the central shoot. It is commonly known

as (dead heart) the control of this pest is to spray plants in the initial period of growth (Kfiretal, 2002).

Another pest is corn earworm, as result of crop damage, larvae feed on leaves, tassels, whorl, silks, and within ears, when larvae feed on corn silk, they clipped these off prior to feeding on the corn ears , the ears are the preferred sites for corn earworm attack, damage is characterized by extensive excrement at the ear tip. They remain feeding in the tip areas until they leave to pupate in the soil, I control biology a variety of natural enemies may help suppress (ew infestation but information is laking, chemical control the following carbery ,Cyflutrin, esfenvalerate) (Muddathir, 1976).

2.2. *Rhopalosiphum maidis*

2.2.1Biology

The aphids are probably best known as (green fly on roses or black flyno broad beans. They belong to a group of inseams known as (buoys) or attempter, the mouth parts of which one modified to from piercing and sucking tubes, the meets obtainer their food by sucking plant juices or the blood of the animal, water boatmen, for example, are hemipterans which prey on other pond creatures the from – Hooper sandcuckoo – spit insects drown fluids from plants – this group of insects has an incomplete no pupal stage but a series of amount is which the nymph granary becomes a math adult.

There are over 400 species and varieties of aphids but the account given below applies in general to those commonly encountered as grad and orchard past. .(El-Ibrashy *et al.*, 1972).

2.2.2 Scientific classification

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Hemiptera

Family: Aphididae

Genes: *Rhopolasiphum*

Species: *maidis*

2.2.3 Life cycle

A generalized life cycle begins in the spring with the hatching of overwintered eggs just as the new growth on plants is developing. These aphids are all wingless females, each of which without fertilization bears succeeding generations of as many as 100 more live wingless females. Incredibly, the aphids are actually born pregnant—even before birth; the female’s own daughters are developing within her. This strategy of bearing live young without fertilization accounts for the extreme rapidity with which most aphids excrete a sweet, sticky substance called honeydew as they feed. This sugary protein mixture can coat the plant and everything under it. Honeydew serves as a food source for ants, bees, and flies. Some of the insects attracted to the honeydew prey on the aphids, but others—ants, for example—attack the beneficial predators. For this reason, controlling ants is an important part of aphid reduction. Honeydew also serves as a medium for the sooty mold fungus which appears as a black film growing over it. Aphids often go unnoticed in the landscape until a tree begins dripping honeydew

onto the sidewalk, roof, deck, and parked cars. The health of the plant may not be threatened by large aphid populations, but the honeydew is such a nuisance that controls become necessary. In the vegetable garden aphids can seriously affect plant growth and controls are usually required.(Website, 2013).

Aphid populations can grow, making control difficult. Young plant shoots can quickly be completely covered with a teeming colony of aphids.

As the colony grows it may begin to run out of room or food may become limited. When this occurs the aphids adapt by producing winged females which can colonize surrounding plants. Late in the fall, sexual males and females are produced. After mating the female lays one or more overwintering eggs. Protected in plant crevices, these eggs withstand inclement weather to hatch in the spring, repeating the cycle. Aphid species found on indoor plants or in tropical climates do not need to produce eggs, and thus males only function is fertilization may never appear.(Website, 2013).

Aphids can feed on all plant parts, but most prefer young shoots and leaves. They feed by inserting their sodastraw like mouth into the plant tissue and sucking out the nutrient-rich juice. Aphids become a pest when their feeding begins to affect plant health a plant may gradually weaken as fewer nutrients become available to it. Aphids can also cause stunting and distortion of plant parts, further weakening (Website, 2013).

2.2.4 Control

Aphid predators may be introduced into the landscape to supplement existing populations. The most common predator sold is the lady bird beetle.

Unfortunately these beetles have a tendency to disperse when released. Their presence will benefit the general area but probably won't do much to affect the aphid population in the immediate vicinity. A better choice for introducing predators is the green lacewing. These are available both as eggs and as larvae. The larvae are more expensive and harder to obtain, but they are more effective at aphid suppression (www., 2014).

Chemical control should be the last resort in any pest control program. The least-toxic chemical for aphid control is insecticidal soap. This should be applied carefully, according to label directions, only to the affected plant areas. It will kill aphids on contact, but does not provide any lasting preventative effect so applications will probably have to be repeated. It is effective in bringing aphid numbers down so that natural predators can regain control. For a cheaper alternative, mixing several tablespoons of a simple liquid soap with a gallon of water and squirt with plant sprayer can be effective.

Pyrethrum or pyrethrin-based insecticides are widely advertised as “natural” pesticides. Derived from plants or laboratory synthesized analogs, these pesticides are less toxic than some other commercial products but are nonetheless potent insecticides and are toxic to humans. They are wide-spectrum insecticides which can kill beneficial insects. These contact insecticides have to be sprayed on the plant to be effective.(www,... 2014).

2.3 Damas

Family Combretaceae contains about 20 genera and about 600 species found in tropical and sub-tropical regions of the world, the family has few genera with great economic value, an useful timber is obtained from some species

belong to it and other species have medicinal importance. *Conocarpus lancifolius* Engle is one of the most important trees in this family (Pandey and Misra, 2008).

2.3.1 Scientific Classification

Kingdom: Plantae

Order: Myrtales

Family: Combrataceae

Genus: *Conocarpus*

Species: *lancifolius*

2.3.2 Description

Large trees up to 20m high dark brown, deeply fissured, branches, narrow lanceolate 7-14x1-1.5cm glabrous shiny petioles 5-7mm long. inflorescence terminal panicle heads. Flowers small, cream coloured strongly scented and attractive to insects, sepals green cup shaped 5 lobed petals absent, stamens slender protruding from the cup.

Fruit small scale-like 2 winged, one seeded on cone like heads overlapping and separating at maturity brown curved and very light, flowers Feb-March, fruits March, April (El-Amin, 1990).

Damas is an evergreen tree that grows up to 20m in height and 60-250 cm or more in diameter. However, it is believed that the larger trees have now been almost entirely felled. Whereas it is usually a multi-branched tree in its natural habitat, trees planted in the Sudan formed single, straight stems (NAS, 1983). Flowers are yellow-green, in round heads on branched stalks, slightly

fragrant and its fruit exists in dry, round, greenish heads, cone-like containing tiny, scale-like hard seeds (Beinet *al.*, 1996).

2.3.3. Distribution

Natural stands of *Acacia* are found beside intermittent water courses of northern Somalia and in the south west part of the Arabian Peninsula. Some of these streams are salty and some sulphurous. The tree is also cultivated in Somalia, Djibouti, Sudan, Kenya, North and South Yemen, and Pakistan. A small plantation has been established in the Sudan in Khashm El Girba arboretum and about 10000 trees have been planted successfully in limestone near Mombasa, Kenya (NAS, 1983).

Native of Somaliland and Saudi Arabia, introduced to the Sudan in 1950 as a shelterbelt species in Khartoum, Kassala, Blue Nile and Kordofan (El-Amin, 1990).

2.3.4 Economic importance

C. lancifolius is multipurpose; wood which is the main product is used domestically for house construction, fire wood and excellent charcoal. Commercially timber was more useful formerly, it was cut and exported from Somalia to Arabia for dhow construction, other potential uses include wood based board, bark may be a useful source of tannins (Booth and Wickens, 1993).

2.3.5 Chemical construction

Chemical construction of *Conocarpus* plant revealed that sterols, triterpenes, flavone aglycones, emodols (anthracenosides aglycones), coumarins, coumarin lactone derivatives, tannins (gallic), reducing compounds,

anthrocnosides, sterols glycosides, cardenolides, saponins and sapogenins are present in the plant (Jagessaret *al.*, 2010).

2.3.6 Uses

Conocarpus was used in its native countries as folk remedy for anemia, catarrh, conjunctivitis, diabetes, diarrhea and fever (Abdulrahman and Gumgumjee; Abdel-Hameed, *et al* 2013) reported that methanolic extracts of *Conocarpus* have a high antioxidant and hepatoprotective properties when tested against mice.

Conocarpus tree is a pioneer species in reforestation projects in its native habitat. *Conocarpus* is one of the fastest growing trees there, producing large quantities of firewood, also Damas wood used for housing construction. *Conocarpus* is suitable for stabilizing riverbanks and improving poor, nutrient-deficient soil and also used as ornamental shade trees and windbreaks around irrigated farms (WCMC, 1998).

The tree's wood is dense and suitable for charcoal. Good fodder for goats and camels as well, so it must be protected when small although the leaves contain tannin. The growing trees there producing large quantities of firewood it also provides strong poles and timber. Damas is used for fuel (Amina, *etal*; 2011).

2.4 Cature

2.4.1: Description:

Large ever green tree 24-40m high, with stout trunk often short and crooked, crown open and widely spreading irregular. Bark is smooth and white gray. Twigs are long slender, with angled reddish coloured. Leaves are alternate, narrowly lanceolate about 8-22 long and 1-2cm wide, often curved or

sickle – shaped, tapering to a long point, short pointed at base with dull pale green on both surfaces and occasionally grayish . Umbels single at leaf base 2,5cm long on slender stalk. Flowers about 5-10, each on slender stalk (Auxiliary), greenish white in colour. Capsules are several, seeds hemiglobose 7-8 long with light brown color (Little, 1983).Fruiting January-February. Wood hard, red durable, resistant to termites, used in construction for structural purposes (Thirakul, 1984).

2.4.2 Scientific Classification

Kingdom: Plantae

Order: Myrtales

Family: Myrtaceae

Genus: *Eucalyptus*

Species: *camaldulensis*

2.4.3 Distribution

*Eucalyptuscamaldulensis*Dehn is said to be the most widely distributed eucalyptus It is indigenous to eastern Australia and Tasmania in most of arid and semi – arid region but not the humid western coasts.It is cultivated in southern Europe and South Africa (Varro *et al.*,1981). Plantation Occurs in Argentina, Egypt, California, Kenya, Morocco, Nigeria, Pakistan, Senegal, Siraleon, Spain, Tanzania, Upper Volta, Uruguay, and Zimbabwe. In Sudan, The species was planted along the banks of the Blue Nile River. However Eucalyptus micro theca is another species planted in the irrigated area of the Gezira Scheme (Duke, 1983). It is readily recognized by the striking characteristic smell of its bark (Thirakul, 1984).

2.4.4 Uses

Volatile oils which are introduced into medical uses contain 55-70% lineol, plus lesser amount of volatile aldehydes (Varro, *et al* 1981). In addition, Ethanolic extract from *Eucalyptus camaldulensis* proved to have medical importance (Atta, and Alkofahi., 1998). Essential oil from *Eucalyptus* sp, was used as antibacterial antimicrobial and acaricidal agent (Bagherwl, Harkenthal, and Lisin., *etal.*, 1999). In traditional medicine red gum *Eucalyptus* is a folk remedy for Colds, Colic, Cough, Diarrhea, Dysentery hemorrhage, Laryngalgia, Laryngitis, Pharyngitis Sorethroat, and Wounds (Duke and Wain, 1981).

Eucalyptus camaldulensis adapts well to cultivation, though it often grows too large for home gardens. It has been used as a street tree, and is useful in public areas with wet soils. It can grow very quickly in cultivation and flower profusely. It can flower in its third year of growth in cultivation in optimal conditions. Birds are attracted to its flower heads. However, in some years its leaves are infested with leaps and detract from its appearance (Boland; *et al* 2006). A row of *E. camaldulesis* was planted at the Royal Botanic Gardens, Sydney in 1813, and the trees are still healthy (Moradshahi, *et al* 2003).

The tree is used for firewood and as charcoal in many countries, in erosion control, on sand dunes and as a roadside shade tree in many places, and in Uganda is used to drain swamps. Plantation 15–20 years for poles and 30–60 years for logs for sawing (Smith and James, 1793).

In cultivation, *E. camaldulesis* grows to altitudes of 1,600 meters (5,200 Ft.), withstanding average minimum temperatures of 3 °C (37 °F) and maxima of

35 °C (95 °F). The heartwood is extremely durable and resists marine borers it is used as a round timber for construction of wharves and fencing. The wood is light reddish brown in color and coarse-textured. The weight can vary widely between individuals and stands, averaging 38 pounds per cubic foot(Fairle, 2000).

2.5 Moringa

Moringa is also the common name of a particular species, *Moringaoleifera*.

Moringa, native to parts of Africa and Asia, is the sole genus in the flowering plant family Moringaceae. The name is derived from the Tamil word murungai which refer to *M. oleifera*.

It contains 13 species from tropical and subtropical climates that range in size from tiny herbs to massive trees. The most widely cultivated species is *M.oleifera* , a multipurpose. Tree native to the foothills of the Himalayas in north western India and cultivated throughout the tropics.*M.stenopetala*, an African, is also widely grown ,but to a much lesser extent than *M. oleifera*Moringa grows quickly in many types of environment (Brawn,2003).

2.5.1 Scientific Classification

Kingdom: Plantae

Order: Brassicales

Family: Moringaceae

Genus: *Moringa*

Species:*oleifera*

2.5.2 Description

Short, slender ,deciduous ,perennial tree ,to about 10m tall; rather slender with drooping branches ;branches and stems brittle ,with corky bark; leaves feathery ,pale green, compound, trip innate ,30-60cm long, with many small leaflets, 1.3-2 cm long, 0.6-0.3 cm wide, lateral ones somewhat elliptic, terminal one obviate and slightly larger than the lateral ones; flowers fragrant , white or creamy –white, 2.5 cm in diameter, borne in sprays ;with 5 at the top of the flower ;stamens yellow ; pods pendulous , brown , triangular, splitting lengthwise into 3 parts when dry, 39-120 cm long , 1.8 cm wide, containing about 20 seeds embedded in the pith, pod tapering at both ends, 9- ribbed; seeds dark brown , with 3 papery wings .Main thick fruit production in March and April in Sri Lanka (Gamal,*et al.*, 2004).

2.5.3 Nutrition

Much of the plant is edible by humans or by farm animals .The leaves are rich in protein, vitamin A, vitamin B, vitamin C and minerals. One hundred grams of fresh Moringa leaves have:2 times the protein of 100g yogurt (Moringa 8.3 g , yogurt 3.8 g);4times the calcium of 100 g milk (Moringa 434 mg , whole cow milk 120 mg); the same potassium as 100 g banana (Moringa 404 mg banana 376 mg); the same vitamin A of 100 g carrot (Moringa 738ug , carrot 713 up);3 times the vitamin C of 100 g orange (Moringa 164 mg , orange 46.9 mg).Feeding the high protein leaves to cattle has been shown to increase weight gain by up to 32% and milk production by 43 to 65%. The seeds contain 30 to 40% oil that is high in oleic acid, while degreased meal is 61% protein (Gamal and Mohamed, 2000).

Chapter Three

Materiel and Methods

3-1 Materials

1. Plastic cups
2. Rubber bands
3. Mushin
4. Brunch (1-15 mm)
5. Scissor
6. Labels papers
7. Plant extracts

3.2 Methodology

3.2.1 Collocation of plant material

Leaves of three plants were collected from agricultural areas of Shambat (College of Agricultural Studies-farm). The three plants were moringa (*Moringaoleifera*), damas(*Conocarpuslancifolius*),and cafure(*Eucalyptus camaldulens*), plates (2 , and 3).

3.2.2. Insect rearing

Adult of *R. maidis* were attained from Laboratory of Entomology - College of Agricultural Studies (plate 1). Insect rearing were continue inside a plastic container under room temperature until the time of the experiment.

3.2.3 Methods of experiment

The aqueous extracts of the three plants (moringa, damas, cafure) were used. Sorghum leaves were treated with three different concentrations (10%, 20%, and 30%) of each plant extract then were placed in plastic petri dishes (9cm). Ten adults of *R .maidis* were added to the treated leaves of each petri dishes.

As control same numbers of insects were added to some petri dishes contains sorghum leaves without ethanol extract.

All the used plastic dishes in the experiment were enclosed with sterilized muslin which fixed closely with a rubber band. The experiment was carried out in three replicates.

Observations of the experiment were noticed daily and the data was recorded by counting the mortality of insect adult after 24hours and 48hours.



Plate(1): Sorghum aphid *R.maidis*



a) DAMAS

b) CAFURE

c) MORINGA

Plate (2): Dry leaves of the tested plants



Plate (3): Powder of the three tested plants

3.2.4 Data analysis

The experiment was carried out in Completely Randomize Design (CRD). Statistical Analysis Software (SAS) was used for data analysis. Duncan Multiple Range Test (DMRT) was used for comparison between means.

CHAPTER FOUR

RESULTS AND DISCUSSION

The effect of three different concentrations of three plants aqueous extracts on *R. maidis* adult mortality after 24h of treatment, was shown in (table 1 and figure 1). The results showed that, the highest percentage of mortality was obtained by the plant damas at concentration 30%, while leaves treated with moringa showed lower mortality at all concentrations.

Table (1). The effect of three different plants aqueous extracts on *R. maidis* mortality after 24h of treatment

Treatments (concentrations)	Adult mortality		
	Maringa	Damas	Cafure
10%	1.0 ^{cde}	1.3 ^{cde}	2.3 ^{abc}
20%	0.7 ^{de}	2.7 ^{ab}	2.0 ^{abcd}
30%	1.0 ^{cde}	3.0 ^a	1.0 ^{cde}

C.V% = 56.3

SE= ±0.8

Aqueous extract of cafure at 10 % concentration obtained high mortality significantly not different from that obtained by damas at 20 and 30% concentrations.

Aqueous extract of moringa plant at all concentrations represented low mortality which was not significantly different from control.

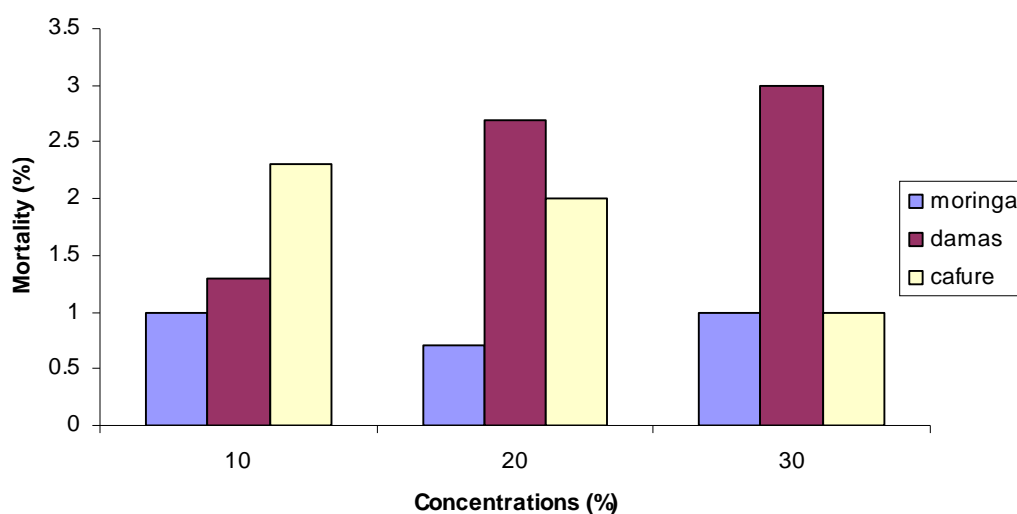


Figure (1) The effect of three different plants aqueous extracts on *R. maidis* mortality after 24h of treatment

As seen in figure (2) and table (2), the results after 48h showed that insect mortality percentages affected more by sorghum leaves treated with concentration 30% of cafure where higher mortality was attained. However, it was more significantly not different from other concentrations for cafure and same as mortality percentages that obtained from 20 and 30% concentrations of damas and concentration 30% of moringa.

Table (2). The effect of three different plants aqueous extracts on *R. maidis* mortality after 48h of treatment.

Treatments (concentrations)	Adult mortality		
	Maringa	Damas	cafure
10%	1.0 ^c	2.0 ^c	2.7 ^a
20%	0.7 ^c	2.7 ^a	2.3 ^{ab}
30%	2.7 ^a	2.7 ^a	3.0 ^a

C.V% = 38.8

SE = ±0.7

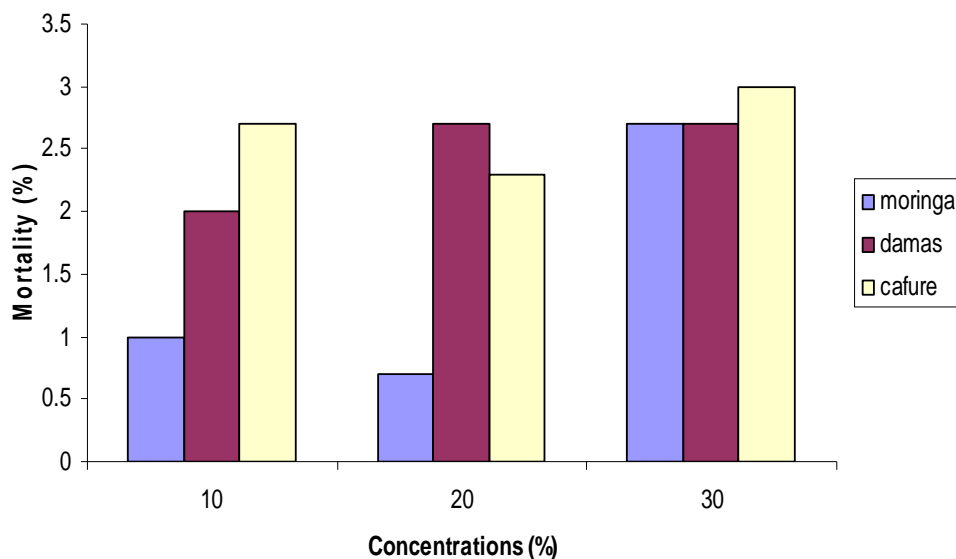


Figure (2) the effect of three different plants aqueous extracts on *R. maidis* mortality after 48h of treatment.

No significant difference was observed between mortality percentages obtained by moringa at concentrations 10 and 20% and by damas at 10% concentrations and control, where they were attained the lower mortality of the insect.

For more details appendix A and B could be seen.

From the results above it was clear that, damas at 30% aqueous extract resulted in high mortality after 24 hours of treatment, which agrees with Omer 2014 who used the powder, aqueous and ethanolic extracts of damas (*Conocarpus lancifolius*) against red flour beetle (*Tribolium castaneum*) and he found that damas was effective to control the insect.

However, the concentration 30% after 48h of treatment of aqueous extract of cafure was obtained the maximum mortality of insect. The results agree with

abdalla (2009) who found that the extract of cafure (Eucalyptus) had the greatest mortality against khapra beetle larvae(*Trogoderma granarium*).

Conclusion and Recommendations

From the results it can be concluded that the best plant as aqueous extract in controlling sorghum aphid was damas and cafure. while moringa plant gave low mortality.

It was recommended that,

- damas could be used as aqueous extract at 30% concentration after 24 hours of treatment.
- cafure could be used as aqueous extract at 30% after 48 hours of concentration.
- moringa could be used at 30% concentration after 48 hours to obtain good results.
- cafure and moringa as aqueous extract need more time for treatment, therefore more study have to be done in future.
- Moringa plant as aqueous extract could be more effective when the time extended for treatment

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Appendices

Appendix (A):ANOVA table of the effect of aquoes extract plants on mortality of sorghum aphid *R.miadis*after 24h of treatment.

Source of variation	D.F	S.S	M.S	Computed F	P>F
Treatment	11	28.63	2.60	3.64*	0.007
Error	18	12.86	0.71		
Total	29	41.50			

Appendix (B):ANOVA table of the effect of aquoes extract plants on mortality of sorghum aphid *R.miadis*after 48h of treatment.

Source of variation	D.F	S.S	M.S	Computed F	P>F
Treatment	11	32.4	2.9	5.04*	0.001
Error	18	10.5	0.58		
Total	29	42.9			